**Quadratic Equations Real Life Application**

**Materials:**

Student Notebooks, PowerPoint, Geogebra

**Purpose:**

The purpose of this activity is to show that the vertex of a parabola y = ax² + bx + c, the highest or lowest point on the graph, can be used in applications to find a maximum or a minimum value. Students will be able to use multiple options to find the function equations and manipulate graphs in geogebra to learn about effects of coefficient’s in the quadratic standard form of an equation.

**Instruction for teachers**: Follow the same directions as the students, but create the graph beforehand, with hide/show boxes of the points, line, slope, and questions. This was prepared so that as the students are completing their instructions you can give confirmation of correct following.

**Day 1**

**Objective is to explore a parabola and find a function equation that fits the picture. (Functions will vary)**

**Student Instruction**

1. Open Leaning Tower of Pisa geogebra file and explore what a, b, and c does to the parabola on top of the picture.
2. Find the function that fits the parabola to the picture.

What is your function?

1. On paper find two points from your function equation and then plot on the graph by:

a. Turn on your Grid

b. Find and mark your point (adjust scaling and increments if necessary)

c. Check your points by substitution into your equation

1. Find the x-intercepts

d. use the selection tool ***intersect two objects*** to plot x-intercepts

1. Draw Vertical lines at these points
2. Think about why x-intercepts could be of importance for the parabola.
3. name and label all points, lines, and graphs

Day 2

Objective is to create a parabola at a **certain** function and explore.

**Problem:**

**Dr. Lobo sells IPhones for Apple. He has found that the average amount of time he spends with each customer is related to this weekly sales volume by the function: f(x) = x (60 – x) where x is the number of minutes per customer and f (x) is the number of cases sold per week.**

**Student Instruction**

**1. Input the function y = x (60 – x)**

**2. Open your Algebra view. What do you notice about the equation we just entered?**

**3. How many cases does he sell if he spends 10 minutes with each customer? 20 minutes? 45 minutes? Complete on your own notebook paper.**

**4. Choose an appropriate scale for the axes and create a graph in geogebra of f(x). Mark the points on the graph corresponding to 10, 20, and 45 minutes.**

**5. In your geogebra file, Draw x = 10, Draw x = 20, and Draw x = 45**

**6. Use Intersect two points selection in geogebra to plot your line/function intersection.**

**7. Describe what you see at the intersection of the line and the function.**

**8. Find the axis of symmetry (Hint: You can use the midpoint equation or midpoint/center selection tool in geogebra)**

**9. Plot a axis of symmetry and change this line to a dashed line.**

**10. Find the intersection of your function and midpoint. This can also be called your VERTEX!**

**11. How long should Dr. Lobo spend with each customer in order to sell as many cases per week as possible? In this case, how many cases will he sell?**

**Directions:**

Begin with the PowerPoint presentation and interject with some discussion questions about quadratics.

Participants should explore the activity “Leaning Tower of Pisa” and should be able to determine vertex points, midpoints, and actions of a, b, and c.

Sample discussion questions:

1. What are the multiple forms to display quadratics?
2. What is a quadratics?
3. What does vertex represent?
4. How can the midpoint formula be useful in this problem?
5. Line of Symmetry?
6. Discuss the relationship that is illustrated.

Reflect on the activity

1. What did you learn in this activity?
2. How could you use this in another real-world situation? Expand and explain.

Extensions to this activity:

Have student’s find their own picture for parabola graph fit

**Discussion:**

* Students come up and display their Geogebra file and demonstrate to the class how they found the points, midpoint, vertex or any other things while exploring. This would ensure that students have an understanding of the graphics of the activity.